Contents

VOLUME I / DESALINATION 73

DESALINATION IN TOTAL WATER RESOURCE MANAGEMENT

3 The increasing demand for desalination
T.A. Dabbagh and A. Al-Saqabi (Kuwait)

27 Treated wastewaters as a growing water resource for agriculture use
I.S. Al-Mutaz (Riyadh)

37 Management and feasibility of reverse osmosis schemes for rural water supply in India
S. Prabhakar, R.N. Patra, B.M. Misra and M.P.S. Ramani (Bombay)

47 Water supply and desalination in northwestern Egypt
O.K. Buros and S. Yacoub (Gainesville, FL and Cairo)

61 Feasibility of seawater desalination to solve water shortage problems of the Salina Cruz (Pemex) Refinery
C.A. Fernández, B.H. Huerta and F.E. Latapi (Mexico City)

NON-TRADITIONAL DESALINATION TECHNOLOGIES

81 DELBUOY: Ocean wave-powered seawater reverse osmosis desalination system
D.C. Hicks, G.R. Mitcheson, C.M. Pleass and J.F. Salevan (Lewes & Newark, DE and Christiansted, St. Croix)

95 Development, testing and the economics of a composite/plastic seawater reverse osmosis pump
D.C. Hicks, W.A. Fearn, C.M. Pleass and D. Staples (Lewes & Newark, DE)

111 Development and application of a roof type solar still
K. Murase, S. Kobayashi, M. Nakamura and S. Toyama (Nagoya)

119 The carrier-gas process — a new desalination and concentration technology
R. Larson, W. Albers, J. Beckman and S. Freeman (Minneapolis, MI and Tempe,AZ)

139 Humidity water vapour collection by absorption cooling machines
S.E. Aly (Jeddah)

167 Prospective of two small water producing units
A.A. Madani and G.M. Zaki (Jeddah)

181 Evaluation of solar powered desalination processes
I.S. Al-Mutaz and M.I. Al-Ahmed (Riyadh)

191 Performance ratio, area economy and economic returns for an integrated solar energy/multi-stage flash desalination plant
D. Singh and S.K. Sharma (Chandigarh)

197 Solar desalination with a high efficiency multi effect process offers new facilities
A. Böhner (Laatzen, FRG)

OPERATIONAL EXPERIENCE — EVAPORATIVE

207 Study of the operating conditions for three large MSF desalination units each of capacity 7.2/8.6 MGD (27360/32832 tons/day)
M.H. Ali El Saie, M.S.I. El Kafrawi and M.I. Kamel (Cairo)

231 Method for extending heat exchanger and condenser life
C.P. Tallman, Sr. (Southport, CT)

247 Review of large desalination plant experience in the Americas
R.M. Ahlgren and I. Smith (Waukesha and Milwaukee, WI)

267 Experiences with 1a highly alloyed stainless steel in desalination plants and other Arabian Gulf industrial plants
J. Olsson and M.L. Erbing (Avesta)

277 Rehabilitation of desalination plants at Sitra Power Station, Bahrain
K. Borashid and K. Kato (Bahrain and Tokyo)

295 A recarbonation process for treatment of distilled water produced by MSF plants in Kuwait
H. Al-Rqobah and A. Al-Munayyis (Kuwait)

313 Practical experience in scale control
M.A.K. Al-Sofi, S. Khalaf and A. Al Omran (Al-Khobar)

327 Operational experience of once through MSF desalination units
A.A. Al Owais, R.K. Nijhawan, P.K. Budhiraja (Kuwait)

341 BELGARD EV — 15 years' experience in scale control
M.A. Finan, S. Smith, C.K. Evans and J.W.H. Muir (Manchester)

359 Studies on MSF desalination — process design, construction and startup of a prototype MSF plant in India
P.K. Tewari, M.S. Hanra, R.K. Verma and M.P.S. Ramani (Bombay)

371 Prevention of the scale trouble of multi-effect stacked desalination plants
Y. Fujioka, M. Soda, M. Zama and I. Shimizu (Tokyo)

385 Experience with MSF desalination plants in Libya
A.I. El-Twaty and S.A. Karshman (Tripoli)

397 Localized corrosion at welds in structural steel under desalination plant conditions:
Part I — Effect of surface roughness and type of welding electrode
407 Part II — Effect of heat treatment, test temperature and test media
N. M.A. Eid (Dhahran)
417 Operating experience of MSF desalination plant at the Abu Kammash Chemical Complex
N.K. Pareek, A. Aboudher, H.M. Hassan Beck and M.M. Elgarni (Tripoli)
429 Light gauge welded titanium tubes for seawater desalination plants
K. Kohsaka, K. Kitaoka, Y. Masuyama, M. Oshiyama, M. Yamamoto and K. Kashida (Japan)
447 Some aspects of the development and operation of the desalination installations with horizontal-tube thin-film evaporators
V.L. Podbereznyi, Ju.K. Smirnov and Ju. V. Putilin (Sverdlovsk)
457 Corrosion behaviour of aluminium-base alloys in desalination plants
O.H. Lebedeva, A.H. Lebedev, M.N. Fokin, S.V. Lomakina, T.A. Severova and B.A. Gromov (Sverdlovsk)
459 Jeddah stack emissions — Problems and solutions
A. Al-Azzaz, J. Abrams, S. Zaczek and L. Awerbuch (Riyadh, San Francisco, CA and Washington, DC)

VOLUME II / DESALINATION 74

OPERATIONAL EXPERIENCE — SEAWATER RO

3 Conventional pretreatment of surface seawater for reverse osmosis application, state of the art
A.Y. Al-Borno and M. Abdel-Jawad (Kuwait)
37 Performance evaluation of SWCC SWRO plants
A.M. Hassan, S. Al-Jarrah, T. Al-Lohibi, A. Al-Hamdan, L. M. Bakheet, M.M.I. Al-Amri (Al-Jubail, Um-Lujj, and Jeddah)
51 New chloramine process to control aftergrowth and biofouling in Permasep^{R} B-10 RO surface seawater plants
L.E. Applegate, C.W. Erkenbrecher, Jr. and H. Winters (Wilmington, DE, Newark, DE, and Teaneck, NJ)
69 Biological fouling and control at Ras Abu Jarjur R.O. Plant — A new approach
S.R. Ahmed, M.S. Alansari and T. Kannari (Bahrain)

85 Performance of materials used in seawater reverse osmosis plants
J. Carew, M.Abdel-Jawad, A. Julka and Y. Al-Wazzan (Kuwait)

113 Improving reverse osmosis performance through periodic cleaning
S.J. Graham, R.L. Reitz, and C.E. Hickman (USA)

125 On the standardization of performance data for reverse osmosis desalination plants
B.A.Q. Darwish, M. Abdel-Jawad and G.S. Aly (Kuwait)

141 Scaling potential of Kuwait seawater for reverse osmosis desalination
S.E. Ebrahim and B.A. Darwish (Kuwait)

157 Corrosion resistant materials for seawater RO plants
A.M. Hassan and A.U. Malik (Al-Jubail)

171 A twenty year case history — the B-9 hollow fiber permeator
I.Moch, Jr (Wilmington, DE)

183 Three-year experience of a seawater RO plant operating at a conversion greater than 50% in the Cayman Islands
H.Winters (Teaneck, NJ)

187 Economic and technical factors affecting seawater reverse osmosis process design
T.E. Sulpizio, W.G. Light and J.L. Perlman (San Diego, CA)

RESEARCH AND DEVELOPMENT — EVAPORATIVE

205 Trihalomethanes (THMs) formation in multi-stage flash (MSF) distillation plants
N.A. Latif, F.M. Al-Awadi and B.A. Colenutt (Kuwait and Uxbridge)

227 A predictive model to find the optimum chlorine treatment scenario for biofouling control
B.A. Al-Hoti (Kuwait)

243 Monitoring of organic compounds in feed and product water samples from MSF plants in the eastern coast of Saudi Arabia
P.C. Mayankutty, A.A. Nomani and T.S. Thankachan (Al-Jubail)

259 Factors affecting the corrosion behaviour of CN 108 alloy in sea water
G. Gusmano, C. Simoncelli, N.M. Valota and E. Traversa (Rome and Milan)

277 The Kuwait University Pilot Plant: A single multi-effect plant to study the variation of evaporation parameters at different temperatures
M.A. Darwish, N.M. Al Najem, T. Froment and J. de Gunzbourg (Kuwait and Paris)

289 A novel 2500 GPD 5-effects wiped-film rotating-disk vapor-compression module: preliminary results
B. Tleimat and M. Tleimat (Alamo, CA)

305 Characteristic features of the desalination plants with thin film heat exchangers
V. Slesarenko (Vladivostok)

317 Simulation of MSF desalination plants
I.S. Al-Mutaz and M.A. Soliman (Riyadh)

327 Transient model of multistage flash desalination
M.A. Rimawi, H.M. Ettouney and G.S. Aly (Kuwait)

339 Electrostatically enhanced evaporation rates of saline water
N.N. Barthakur (Ste Anne de Bellevue)

355 Inhibition efficiency of scale formation by chemical additives
O.D. Linnikov, V.L. Podbereznyi, N.A. Belyshev, V.M. Balakin and V.S. Talankin (Sverdlovsk)

363 Heat transfer in film-type evaporator with profiled tubes
V.G. Rifert, V.L. Podberezny, Ju.V. Putilin, Ju.G. Nikitin and P.A. Barabash (Kiev and Sverdlovsk)

373 Heat exchange at dropwise condensation in heat exchangers of desalination plants
V.G. Rifert, A.I. Sardak, S.V. Grigorenko and V.L. Podbereznyj (Sverdlovsk)

383 Influence of spray density on coefficient of gas dynamic resistance for tube bundles of different configuration
V.V. Ilyushchenko, V.L. Podbereznyi and S.I. Golub (Sverdlovsk)

391 Interaction of spraying liquid and vapour in horizontal tube film evaporators
V.V. Ilyushchenko, V.L. Podbereznyi and S.I. Golub (Sverdlovsk)

VOLUME III / DESALINATION 75

RESEARCH AND DEVELOPMENT — MEMBRANES

3 Solute-solute and solute-membrane interactions in hyperfiltration of binary and ternary aqueous organic feed solutions
W. Pusch, Y.-L. Yu and L.-Y. Zheng (Frankfurt and Dalian)

15 An approximate analytical solution for the performance of reverse osmosis plants
A.E.S. Al-Zahrani, M.A. Soliman and I.S. Al Mutaz (Riyadh)

25 A new dual-function device for optimal energy recovery and pumping for all capacities of RO systems
M.A. Darwish, M. Abdel-Jawad and L.J. Hauge (Kuwait)

41 Predictability of a membrane transport model: A general approach
K. Habib (Kuwait)

55 Predictability of membrane performance of reverse osmosis systems for seawater desalination
B.A. Q. Darwish, G.S. Aly, H.A. Al-Rqobah and M. Abdel-Jawad (Kuwait)

71 The hydraulic turbocharger: A new type of device for the reduction of feed pump energy consumption in reverse osmosis systems
J. Lozier, E. Oklejas, M. Silbernagel (Port Hueneme, CA and Monroe, MI)

85 Design method of reverse osmosis units used in desalination
M.S. Hameed (Baghdad)

97 Simplified analysis of transport in reverse osmosis hollow fiber membranes
M. Abdel-Jawad and M.A. Darwish (Kuwait)

INSTRUMENTATION, AUTOMATION AND CONTROL

119 System identification and control of reverse osmosis desalination
I.M. Al-Atiqi, A.H. Ghabris and S. Ebrahim (Kuwait)

141 Computerized instrumentation and control for reverse osmosis systems
E. Fredkin and R. Banks (Billerica, MA)

149 One year operational experience on the process control system at UANE MSF Desalination Plant
S. Rebagliati, E. Ghiazza, K.S. Abueida (Genoa and Abu-Dhabi)

171 Electrochemical monitoring of the process of boiler cleaning
A.M. Shams El Din and A.M.K. Tag El Din (Abu Dhabi)

185 Measurement of localized metal removal in pipes by gamma-ray back-scattering method
S. Abdul-Majid and U. Dawood (Jeddah)

199 Neutron-capture gamma-ray technique for scale identification inside pipes
S. Abdul-Majid and U. Dawood (Jeddah)

WATER REUSE AND BRINE DISPOSAL

213 Municipal wastewater renovation by reverse osmosis — state of the art
A.H. Ghabris, M. Abdel-Jawad and G.S. Aly (Kuwait)

241 A combined RO/freezing system to reduce inland rejected brine
A.A. Madani and S.E. Aly (Jeddah)

259 Desalination plant at KWK Debiensko, Poland: Advanced mine drainage water treatment engineering for zero discharge
J. Masarczyk, C-H. Hansson, R.L. Solomon and B. Hallmans (Katowice, Gothenburg, Washington DC and Stockholm)

289 Wastewater reclamation and reuse in Europe, Middle East and North Africa
A.A. Al-Khafaji and D.A. Howarth (Washington DC)

315 Potential for water reuse in conjunction with desalination systems
R.M. Ahlgren (Wankesha, WI)

329 Reuse of collected stormwater runoff for irrigation in Kuwait
B.A. Al-Hoti and R. Abdullah (Kuwait)

341 Skid mounted mobile brackish water reverse osmosis plants at different sites in Kuwait
A.L.A. Malik, N.G. Younan, B.J.R. Rao and K.M. Mousa (Kuwait)

363 Pre-treatment and desalination of mine drainage water in a pilot plant
J. Sikora, C-H. Hansson and B. Ericsson (Katowice, Gothenberg and Stockholm)

379 Review of initial three years operation of waste water management scheme at 4640MW Bayswater/Liddel Power Station Complex, Australia
J. Stuart, T. Bryant, I. Fergus and E. Gabrielli (Australia)

VOLUME IV / DESALINATION 76

MEMBRANE SOFTENING AND BRACKISH TREATMENT

3 Operating experience of an RO Plant as pretreatment of the demineralizer system in a cogeneration plant
K. Hamby and J. Chen (Big Spring and Houston, TX)

15 Graphic evolution of the 24,000 hours (3 years) operating data of a RO brackish water desalination plant, in Las Palmas, Canary Islands, Spain
E. R. Saavedra (Las Palmas)

27 Reverse osmosis and ion exchange demineralizer system for Basrah Petrochemical Complex No. 1
G. Ali, J.H. Dalton, P.D. Judges and C-h Tao

39 THM Precursor removal and softening — Ft. Myers 12 MGD RO Membrane Plant, Florida, USA
P.H. Lange, P.E. Laverty, E.D. Edwards and I. Watson (San Diego, CA and Ft. Myers, FL)

53 Design of compact, containerized desalination plants
B. Mace, Austria (Salzburg)

61 Desal-5 membrane for water softening
D.L. Comstock (Escondido, CA)

HYBRID RO/MSF SYSTEMS AND RELATED TOPICS

75 Jeddah 1 RO plant — Phase I: 15 MGD reverse osmosis plant
M. Muhurji, G. Faggard, V. Van Der Mast and H. Imai (Jeddah and Nagasaki)

89 Integrated production of power and water
M. A-K. Al-Sofi (Al-Khobar)

107 On the concentration of RO-brines by seeded horizontal tube falling film evaporation (HTFE)
R. Rautenbach and J. Gebel (Aachen)

121 Technoeconomics of power/desalting cogeneration plants in Kuwait
A preliminary study
A.A.J. Al-Zubaidi (Kuwait)

155 Optimization of dual purpose steam power and MSF desalination plant
M.H. Ali El-Saie and Y.M.H. Ali El-Saie (Cairo)

177 Optimum design for a hybrid desalting plant
I.S. Al-Mutaz, M.A. Soliman and A.M. Daghthem (Riyadh)

189 Hybrid desalting systems
L. Awerbuch, S. May, R. Soo-Hoo and V. Van der Mast (San Francisco, CA)

FEASIBILITY OF SIGNIFICANT COST REDUCTIONS IN DESALINATION (ROUNDTABLE DISCUSSION)

201 Costs for seawater desalination in real terms, 1979 through 1989, and projections for 1999
G.F. Leitner (Elm Grove, WI and Boca Raton, FL)

215 Comprehensive study on capital and operational expenditures for different types of seawater desalting plants (RO, MVC, ME, ME-TVC, MSF) rated between 200 m^3/d and 3,000 m^3/d
G. Fosselard and K. Wangnick (Brussels and Gnarrenburg)

241 Parametric cost analysis study of seawater reverse osmosis systems design in Kuwait
A.A.J. Al-Zubaidi (Kuwait)

281 Technical and economical comparison between large capacity MSF and RO desalting plants
M.A. Darwish, M. Abdel Jawad and G.S. Aly (Kuwait)

305 Technical aspects of reducing desalting water cost by distillation methods
M.A. Darwish and M. Abdel-Jawad (Kuwait)

323 Process arrangements for hybrid seawater desalination plants
I. Kamal, W. Schneider and G.F. Tusel (Homburg/Saar)